Inference concerning multiple multivariate econometric models

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Abstract

Let $\mathbf{Y}$ be a $T \times m$, $\mathbf{X}$ a $T \times k$ matrix, and $\mathbf{U}$ a $T \times m$ random matrices. Let also, $\boldsymbol{\beta}$ be a $k \times m$ matrix of parameters. Consider the following multiple multivariate econometric models,

$$\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{U} \tag{1}$$

where the random matrices $\mathbf{Y}$ and $\mathbf{X}$ are observed, while the matrix $\mathbf{U}$ is the unobserved noise.

In this talk we deal with estimation and testing problems concerning the parameter matrix $\boldsymbol{\beta}$ under general restrictions of the form

$$\mathbf{L_1}\boldsymbol{\beta}\mathbf{L_2} = \mathbf{d}, \quad \text{or} \quad \mathbf{L_1^*}\boldsymbol{\beta} = \mathbf{d}^*. \tag{2}$$

Here, $\mathbf{L_1}$ and $\mathbf{L_1^*}$ are known, $p \times k$ full rank matrices with $p < k$, $\mathbf{L_2}$ is also a known $m \times q$ full rank matrix with $q < m$, and $\mathbf{d}$, $\mathbf{d}^*$ are, respectively, $p \times q$ and $p \times k$ known matrices.

These general restrictions include many types of hypotheses about the parameter matrix. For instance, the hypotheses of homogeneity of the parameters (equality) can be represented in the above form by suitably choosing the matrices $\mathbf{L_1}$, $\mathbf{L_2}$, $\mathbf{d}$ and $\mathbf{d}^*$. The estimation of parameters and testing of homogeneity hypotheses are of paramount interest, both in statistical theory and in related scientific fields such as econometrics. For example, in econometrics, if the data was collected from various sources (countries) under similar conditions, one may suspect some sort of homogeneity in the regression parameters.

In this talk we shall deal with the problem of estimating $\boldsymbol{\beta}$ under one of the constraints in (2). Further, we establish an asymptotic test for the constraints. We propose some shrinkage and preliminary test estimators for $\boldsymbol{\beta}$ and compare their performances to the benchmark quasi-likelihood (or least squares estimator). We demonstrate risk dominance of the shrinkage estimators over the quasi-likelihood in an asymptotic sense. Some simulation results are also showcased which strongly corroborate with our analytical findings. We apply the proposed methodologies to real data sets. We will end this talk with some open problems.